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GB 2348310 A GB 2228814 A EP 0589607 A1
EP 0335467 A1 WO 98/42220 A1 US 5126719 A

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(54) Abstract Title

Sound generating electronic shoes with alarm

(57) An entertaining/protective sound generating system for use with footwear, such as sneakers includes a receiver/alarm circuit located within the sole of at least one sneaker, and a remote hand-held controller. The receiver/alarm circuit in the shoes further includes, a speaker, a speaker driver, an LED array an LED driver circuit, a motion detector, a memory with sound files and a processor for controlling its operation. According to a first embodiment, the user presses a button on the controller, transmitting a signal to the sneakers. The signal will be interpreted by the processor as a request to select a sound file (corresponding to the particular depressed button) from the memory and send it to be amplified and subsequently played by the speaker. The LED's may flash along with the playing of the sound file. In a second embodiment, another button of the controller is activated which puts the receiver in an "alarm mode," wherein the processor awaits receipt of a sneaker-movement or proximity signal from the motion sensor prior to sending a predetermined alarm sound data file to be played by the speaker. In a third mode, a sound file is played for a brief period whenever the motion detector produces a signal.

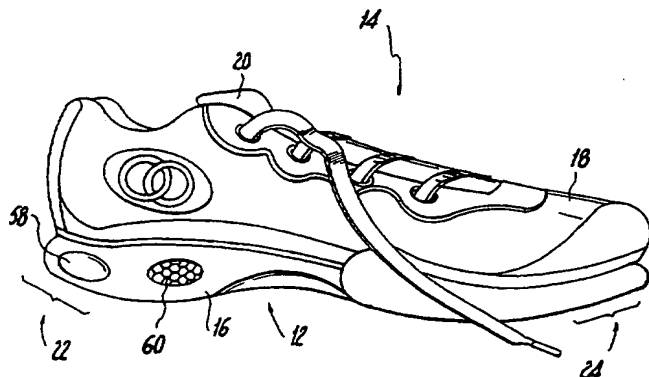


Fig. 1

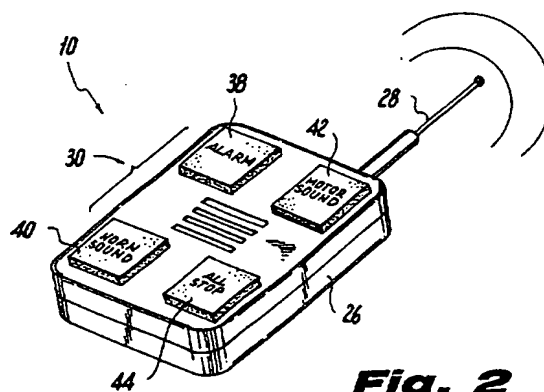


Fig. 2

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print incorporates corrections made under Section 117(1) of the Patents Act 1977.

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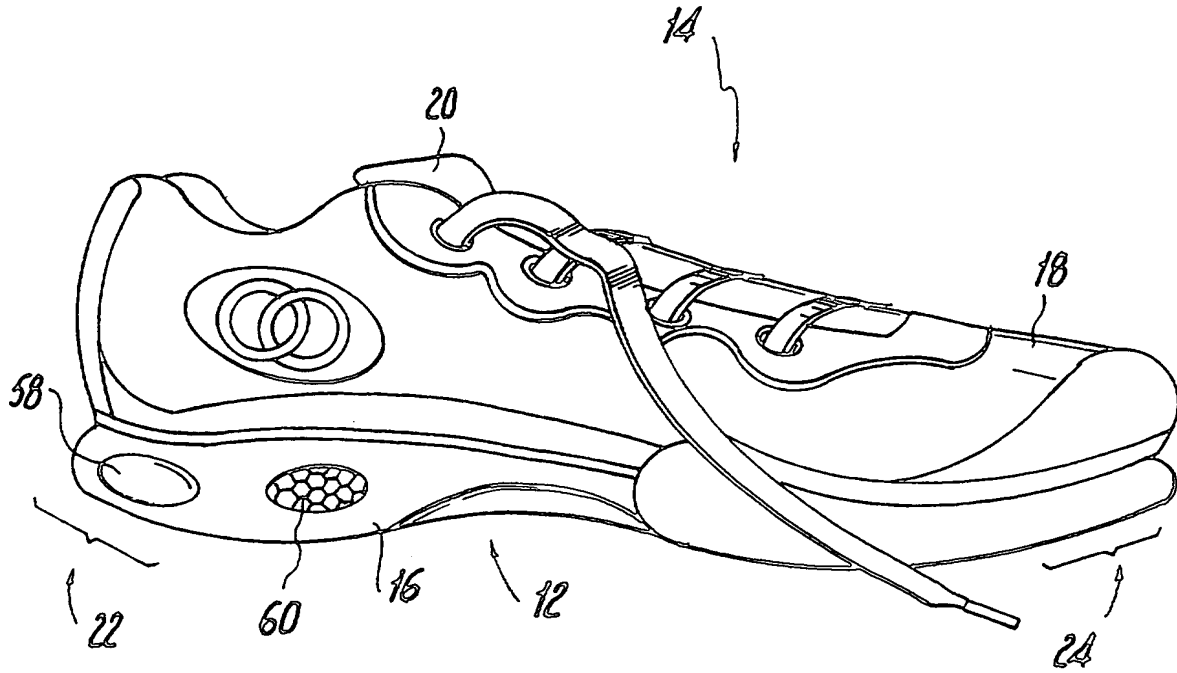


Fig. 1

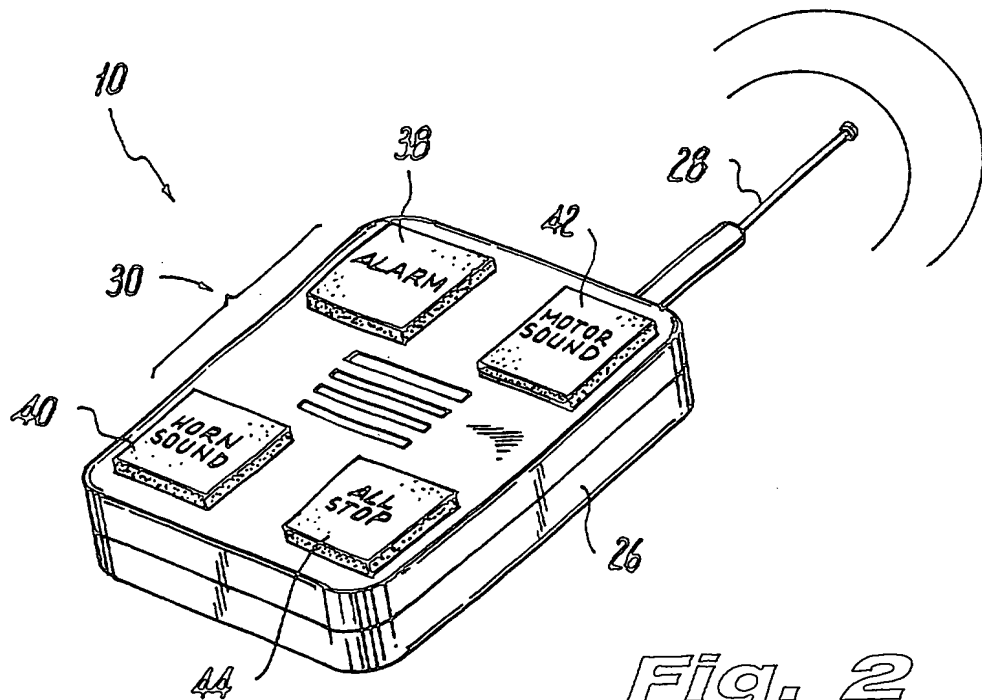


Fig. 2

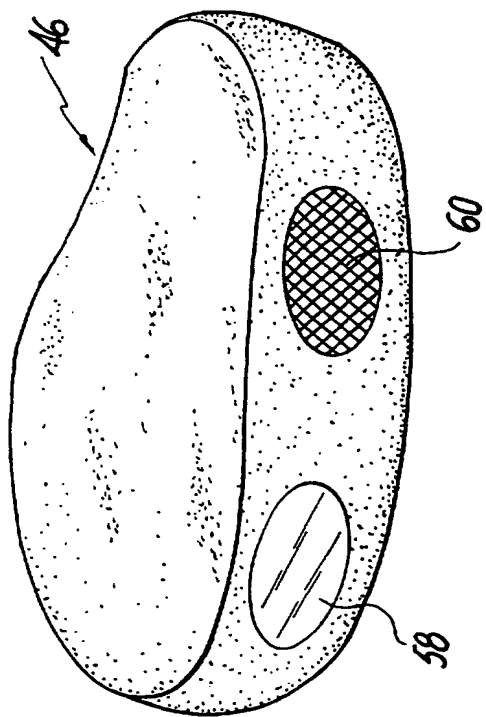


Fig. 3

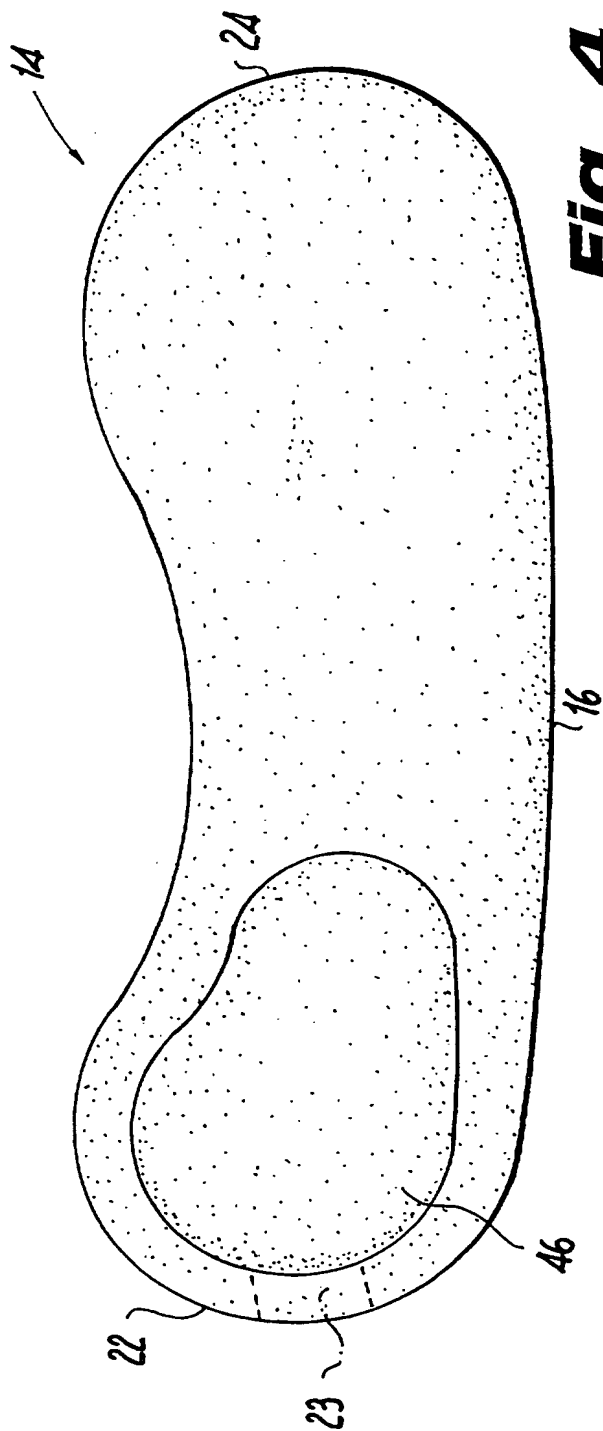
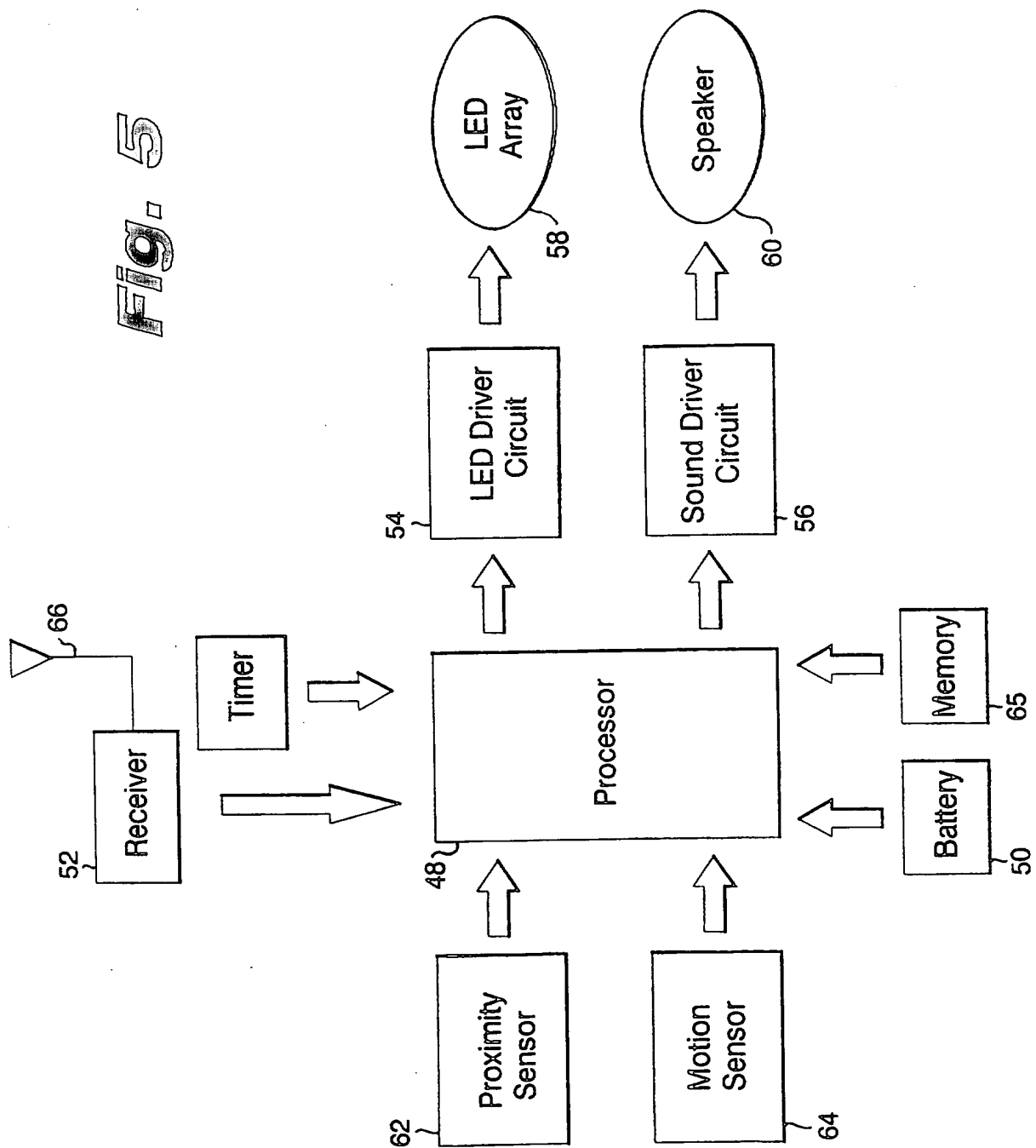


Fig. 4

Fig. 5



ELECTRONIC SHOES

The present invention generally relates to footwear, such as sneakers, and more particularly, to footwear that includes onboard electronics used to help locate the sneakers (or the wearer of the sneakers), to protect unattended sneakers against theft, and to further entertain both the wearer of the sneakers, and those nearby.

Today, it is not uncommon for shoes, in particular sneakers for children, to include entertaining and functional electronics. The electronics usually include a simple timing circuit and/or a movement-sensitive switch, a battery, and an array of LED-type lights. The electronic circuit of the type typically found in popular sneakers today is used to illuminate the LEDs either at regular (or predetermined) intervals, or whenever the shoes are moved a predetermined degree, such as when the wearer walks, jumps, or runs. It appears that the primary purpose of the lighting circuit located in today's sneakers is to entertain both the wearer of the shoes, and those in the vicinity. However, the lighting circuit also, perhaps inadvertently, functions as a warning system (a sort of

moving lighthouse) that allows the wearer of the sneakers to be easily seen by others during the evening hours, in particular, by the drivers of cars.

U.S. Patent No. 5,748,087 issued to Ingargiola et al. discloses a personal alarm system for use with a child. The alarm system is installed within the child's shoes (e.g., sneakers). The shoes of the Ingargiola patent include a battery, a sound generating circuit, speakers, an array of LED's, and a transceiver. According to this patent, the alarm system includes a remote control unit that is intended to be carried by a parent, for example. In one mode, if the distance between the transmitter (i.e., the shoes, and the child) and the remote control (i.e., the parent) exceeds a predetermined distance, such as when the child leaves the immediate area of the parent, the transmitter located in the child's shoes communicates with the remote control unit and automatically activates an alarm sound and illuminates the array of LEDs located within the shoes. In a second mode, the parent may use the remote control unit to automatically active an alarm sound within the child's shoes regardless of the distance between the child and parent. This second mode is useful in helping a parent locate a lost or missing child.

The alarm system of U.S. Patent No. 5,748,087 is intended as a safety child-monitoring/locating system, not as an entertaining device. The onboard array of LEDs and the sound generating circuit of this alarm system are only activated (either lights, sound, or both) when the child is either lost or the parent wants an update on the child's location. While this alarm system may provide a valuable function when a child is lost, the sounds and lights of the alarm system offer no fun or entertainment to the child during non-emergency times, (i.e., most of the time). Also, this alarm system cannot be used as an anti-theft device to prevent unattended (and not being worn) shoes from being stolen.

U.S. Patent No. 5,557,259 issued to Musa discloses a transmitting device that may be attached to a child's shoe. A remote device contains a receiver such that when a child is too far from the receiver, an audio alarm is activated. The remote device, which is intended to be held by a parent, includes a graphic display which may be used to indicate the direction of the transmitting device located in the shoes of a lost child.

U.S. 5,235,761 issued to Chang discloses a shoe that includes an array of LED lights and a sound generator. The sound generator is selectively activated to create various musical and alarm sounds for entertainment purposes. The onboard sound generator is not triggered by a remote control, but is activated automatically as the wearer of the shoes walks or runs and operates in-sync with the particular walking or running movement, not continuously.

U.S. 4,771,556 issued to Kim, discloses sport shoes having a sound generating circuit and speakers. A switch is connected to the fastening system of the shoe and is activated if the fastening system fails while the shoe is in use, so if the user is running and his laces become untied, the switch will active the sound generator and a sound will warn the wearer of the untied laces.

Although much has been done in this field to introduce lights and sounds to footwear, none of these prior art devices protects footwear from theft when they are not being worn, nor do these devices allow a user to produce a combination of lighting and sound effects remotely, while wearing the shoes, or otherwise.

In an illustrative embodiment of the present invention, an entertaining/protective sound generating system for use with footwear, such as sneakers, includes a receiver/alarm circuit

located within the sole of at least one sneaker, and a remote hand-held transmitter/controller. The transmitter/controller includes a series of buttons and appropriate transmission circuitry (which may be similar to that of a conventional TV remote controller or an automobile alarm controller). According to a first embodiment, the receiver/alarm circuit of the sneaker includes a processor, a receiver for receiving transmitted signals, a memory for storing selected pre-recorded sound data, a speaker for selectively playing a selected sound data file from the memory as controlled by the processor, and a motion sensor which detects movement of the sneakers. An amplifier or sound driver circuit may be used to amplify the sound data signal sufficiently to power the speaker. According to a second embodiment of the invention, the receiver/alarm circuit further includes an LED array (or any illumination device) and an appropriate LED driver circuit.

In operation, the user may selectively depress a button which will transmit a signal to the sneakers. The signal will be received by the receiver located within the sneakers and will be interpreted by the processor to either select a sound file (corresponding to the particular depressed button) from the memory and send it to be amplified and subsequently played by the speaker, or activate an "alarm mode" wherein the processor awaits receipt of a sneaker-movement signal from the motion sensor prior to sending a predetermined alarm sound data file to be played by the speaker. The transmitter/controller may include a "stop" button which, when depressed transmits a stop signal to the sneakers to silence a triggered alarm condition.

Accordingly, an object of the invention is to provide a pair of shoes that includes both lights and a sound generating circuit which may be selectively and remotely activated by the wearer.

It is another object of the invention to provide a pair of shoes that includes lights and/or a sound generating circuit that automatically activates in response to attempted theft of

unattended shoes, through either movement, sound detection, or proximity sensing.

It is another object of the invention to provide a pair of shoes that includes lights and a sound generating circuit which overcomes the deficiencies of the prior art.

5 The forgoing and other features of the present invention will be more readily apparent from the following detailed description and drawings of illustrative embodiments of the invention wherein like reference numbers refer to similar elements throughout the several views and in which:

Fig. 1 is a perspective view of a sneaker having a sound-generating circuit, an LED
10 and a speaker, according to the invention;

Fig. 2 is a perspective view of a control unit, according to the invention;

Fig. 3 is a perspective view of an insert for a shoe which is adapted to house the sound-generating circuit, according to the invention;

Fig. 4 is a plan view of a sole portion of the sneaker of Fig. 1, showing the insert of
15 Fig. 3 in an installed position therein, according to the invention; and

Fig. 5 is a block diagram of a circuit for operating the lights and speaker of the present invention.

20 The invention includes two main components, a transmitter/controller 10, and a receiver/alarm circuit 12. Receiver/alarm circuit 12 is located within sneaker 14 (either one or both of a pair of sneakers), while transmitter 10 is preferably housed in a hand-held unit, as shown in Figs.

1 and 2.

Referring to Figs. 1 and 2, sneaker 14 includes a sole 16, an upper 18, a tongue 20, a heel end 22, and a toe end 24. As shown in Fig. 2, transmitter/controller 10 includes a housing 26, a transmitting antenna 28 (antenna 28 may be located entirely within housing 26), and a series of push-buttons 30. Internally, controller 10 also includes a battery and internal transmitting circuitry.

Push buttons 30, as explained in greater detail below, may be selectively depressed to active the internal circuitry to cause a predetermined signal to be transmitted from antenna 28. Also, as described in detail below, according to a preferred embodiment of the invention, push buttons 30 include an "alarm" button 38 which may be used to transmit an alarm mode signal to sneakers 14, a "horn" button 40 which may be used to transmit a "horn" signal to sneakers 14, a "motor sound" button 42 which may be used to transmit a motor sound signal to sneakers 14, and a "stop" button 44 which may be depressed to transmit a "stop" signal to sneakers 14, as desired by the holder of controller 10, which may be the wearer of sneakers 14.

Referring to Figs. 3 and 4, as introduced above, receiver/alarm circuit 12 is located within heel end 22 of sneaker 14, preferably in the form of an encased insert 46. Encased insert 46 preferably includes all the main parts of receiver/alarm circuit 12 shown in Fig. 5. This includes a processor 48, a battery 50, a receiver 52, an LED (light emitting diode) driver circuit 54, a sound driver circuit 56, an LED array 58, a speaker 60, a proximity sensor 62, a motion sensor 64, and a memory 65. As discussed below, depending on the type of signals transmitted by transmitter/controller 10, a receiving antenna 66 of receiver/alarm circuit 12 (if radio waves are used) or an appropriate input sensor 68 (if Infra-Red energy is transmitted, similar to a TV remote control unit) may be located in some other part of sneaker 14, such as tongue 20 or another part of sole 16

or upper 18. Also, depending on the particular construction of the shoe or sneaker, it may be more desirable to locate other parts of receiver/alarm circuit 12 in other parts of sneaker 14, such as battery 50, LED array 58, speaker 60, proximity sensor 62 and motion sensor 64.

As is understood by those skilled in the art, the various elements of the receiver/alarm circuit, described above, may be mounted within a sneaker (or any footwear) in a suitable manner and arrangement according to the particular shape, size, and type of footwear, as well as the materials used to manufacture the footwear. In the case of sneakers, rubber-based materials are generally used to construct the sole, heel, and toe portions. In such instance, the components of the receiver/alarm circuit 12 may be "molded" individually at various predetermined points within the sole and heel portions during assembly of the sneaker, such as just before the upper is adhered to the sole assembly. Alternately, as suggested above, a majority of the components of receiver/alarm circuit 12 may be pre-molded within a resilient heel insert 46, as shown in Fig. 3.

Battery 50 may either be molded in an inaccessible location within sneaker 14 (whereby battery 50 would power the internal circuitry through the life of the sneaker 14), or located within an accessible battery chamber (not shown), whereby batteries could be replaced as necessary.

The present invention may be described as having three modes of operation. A first operation mode includes the operation of LED lights only, with no sound. A second operation mode allows the wearer of sneakers 14 to selectively cause on board speakers 60 to generate pre-recorded sounds (i.e., sound effects) which are stored in memory on the sneaker. A third operating mode is an alarm mode which may be used to protect unattended (and not being worn or otherwise used) sneakers from theft (accidental or deliberate). This alarm mode, as described in detail below, may be triggered by motion of the sneakers or by detection of anyone within the proximity of the stowed

sneakers.

In a first mode of operation, referring to Figs. 1 and 5, as a wearer uses sneakers 14 (e.g., walks, runs, and jumps while wearing them), the wearer (or a friend nearby) may operate transmitter/controller 10 to control the operative mode of receiver/alarm circuit 12 located within sole 16 of sneakers 14. For example, the wearer may depress button 42 marked "Motor Sound" to cause transmitter/controller 10 to transmit a "motor sound" signal to receiver/alarm circuit 12. Receiver 52, with antenna 66 (or an IR input device) receives the "motor sound" signal and inputs the same to processor 48. Upon receipt of the "motor sound" signal, processor 48 sends sound data corresponding to the sound of a motor (in this example) from memory 65 to sound driver circuit 56, which in turn operates speaker 60 so that "motor sound" from memory 65 is transmitted audibly from speakers 60.

Of course, any of many synthesized sounds may be stored in memory 65, and subsequently activated (caused to be played through speakers 60), by either the wearer of sneakers 14, or a nearby friend or parent. If the user presses button 40, labeled "horn sound" located on transmitter/controller 10, a horn sound signal will be transmitted and received by receiver/alarm circuit 12, and as described in the "motor sound" example above, processor 50 will cause sound data corresponding to the sound of a horn to be amplified by sound driver circuit 56 and played through speakers 60. Each individual sound does not necessarily have to have a dedicated button located on transmitter/controller 10, but may instead may be activated in a predetermined (or random) sequence that is triggered each time a "change sound" button (not shown) on transmitter/controller 10 is

depressed so that the user may run through the different sounds by repeatedly pressing the change sound button until the desired sound is heard, at which point the user may release the change sound button. Once selected, the desired sound may continue to play through speakers 60 for a predetermined period of time, or alternatively, until stop button 44 located on transmitter/controller 10 is depressed. As a further alternative, once sound button 44 is activated, the sound may be produced for a fixed period of time each time motion sensor 64 produces a signal (indicating sneaker movement).

According to this first mode of the present invention, LED array 58 may be driven simultaneously to the playing of a particular sound effect, or alternatively, may be driven a predetermined period of time after processor 48 receives a particular sound signal (e.g., motor sound signal), or as triggered by a dedicated button (not shown) located on transmitter/controller 10. The LEDs may also flash for a fixed period of time after each signal produced by motion sensor 64.

According to a second embodiment of the invention, once the wearer of sneakers 14 removes his sneakers and stows them, for example, along side a pool, or playground, or on the shore of a swimming pond, the wearer may selectively use transmitter/controller 10 to activate a second mode of operation. Once the user depresses button 38, labeled "alarm" in Fig. 1, an alarm mode signal is transmitted to and received by antenna 28 of receiver 52. The alarm mode signal is then sent to processor 48, which in turn activates an alarm mode condition. During this alarm mode condition, once triggered, as described below, processor 48 will send sound data (preferably stored in memory 65) which corresponds to an appropriate alarm through sound driver circuit 56 to be

played (loudly) through speakers 60. During this alarm mode condition, processor 48 is triggered when sneakers 14 are moved as detected by motion detector 64. When this occurs, processor 48 receives a movement signal from motion detector 64 and subsequently becomes triggered, releasing the alarm sound data from memory 65 to speakers 60, as described above.

5 Once the alarm has been triggered by movement (indicating a possible sneaker- theft attempt), the audible (and/or visual- illumination) alarm sound will continue either until stop button 44 located on transmitter/controller 10 is depressed, or after a predetermined period of time. The alarm sound is preferably sufficiently loud to summon the owner of the sneakers, or to scare the potential thief away, while hopefully preventing the theft of the sneakers.

10 According to the invention, when the owner of sneakers 14 first activates the alarm of receiver/alarm circuit 12, as described above, a "beep-beep" sound is played through speakers 60, as sent from memory 65 by processor 48 through sound driver circuit 56. The alarm sound is preferably similar to the alarm sound of a conventional car alarm including the signature "beep-beep" sound made by the car alarm when the car user first activates the alarm. This indicates that the alarm
15 has been successfully activated.

 In place of, or in addition to motion sensor 64, proximity sensor 62 may be used to sense the relative proximity of sneakers 14 and any person nearby. Should a person approach sneakers 14 (perhaps to move the sneakers), proximity sensor 62 will detect the advance of the person and trigger processor 48 to activate the alarm sound, as described above. As a further
20 alternative, the proximity detector can be used to indicate when the sneakers, and anyone wearing them, are more than a predetermined distance from controller 10.

 The LEDs may also be caused to flash when the alarm is activated. This will call

additional attention to the stolen shoes.

By pressing the stop button, the circuit can be taken out of the alarm mode so that the owner of the shoes can wear them (or otherwise move them) without triggering the alarm.

5

According to a third embodiment of the invention, receiver/alarm circuit 12 located in sneakers 14 may include an illumination-only mode wherein LED array 58 is selectively activated as the wearer runs, walks, or jumps, a movement which is detected by motion detector 64. In this illumination-only mode, a sneaker-movement signal is sent to processor 48 (when sneaker movement is detected), which in turn, operates LED driver circuit 54 so that LED array 58 illuminates according to prescribed "firing order", sequence, duration, and intensity.

In this illumination-only mode, LED array 58 may operate independent of the above-described first (sound generator) mode and second (alarm) mode, or may operate independently as the wearer uses the sneakers 14 until a sound signal is received by transmitter/controller 10 or an alarm mode signal is received by transmitter/controller 10, at which point LED array 58 may then operate in a synchronized manner according to the particular sound data being played by speakers 60, as described above.

In each of the above-described modes, battery 50 preferably supplies power to all the electrical components of receiver/alarm circuit 12, including processor 48, LED driver circuit 54, sound driver circuit 56, LED array 58, speaker 60, and receiver 52. Since speaker 60 and sound driver circuit 56 consume relatively more power than the other components of receiver/alarm circuit 12, these components may include a dedicated (easily replaceable) battery (not shown). Regardless,

20

battery 50 may either be accessibly mounted within a portion of sneaker 14 so that they may be accessed through a closeable slot 23 (shown in dotted line in Fig. 4), and replaced by the owner when necessary. Alternatively, batteries 50 may be sealed within sneakers 14 during their manufacture, in which case battery 50 would power all on-board electrical components through the useful life of the sneaker.

Although the above receiver/alarm circuit 12 is described with processor 48, it is to be understood, that processor 48 is not necessary for the invention to operate and that other circuits may be used to play predetermined sounds through speaker 60 located on sneaker 14, as is understood by those skilled in the art. Each element of transmitter/controller 10 and receiver/alarm circuit 12 is commercially available and the particulars of the circuits are easily understood and implemented by those skilled in the art.

Speaker 60 may be any suitable type including conventional electro-magnetic, or piezo crystal sound transducers, or any sound-generating device including bells and buzzers.

Although the application of the invention illustrated in this application is directed to sneakers, the sound-generating system of the present invention may be applied to any type of footwear, including shoes, boots, sandals, "flip-flops", skis and ski boots, ice skates, and in-line skates.

It is believed that the advantages and improved results furnished by the method and apparatus of the present invention are apparent from the foregoing description of the preferred embodiment of the invention. Various changes and modifications may be made without departing from the spirit and scope of the invention as described in the claims that follow.

What is claimed is:

1 1. An entertaining sound-effects generator for footwear, comprising:
2 an alarm circuit including a sound generator, said alarm circuit being attached to said
3 footwear and including a reset switch;
4 a motion detector attached to said footwear, said motion detector adapted to detect
5 movement of said footwear;
6 means for causing said sound generator to generate a sound in response to said motion
7 detector detecting movement of said footwear; and
8 means to selectively silence said sound generator in response to activating said reset
9 switch.

1 2. An entertaining sound-effects generator for footwear, comprising:
2 a sound-generating circuit attached to said footwear including a sound generator and
3 an electronic memory, said electronic memory selectively storing sound data;
4 a remote switch for causing said sound data to be transmitted from said electronic
5 memory to said sound generator, said switch being remote of said footwear; and
6 a circuit which causes said sound generator to generate a sound upon receipt of said
7 sound data from said electronic memory.

1 3 An anti-theft system for footwear, comprising:
2 an alarm circuit located in said footwear, said alarm circuit including a receiver, a
3 motion sensor, and a sound generator, said alarm circuit having an operative condition and an off

4 condition, and

5 a hand-held controller including a transmitter with at least one switch, said at least
6 one switch controlling the transmission of at least one alarm signal from said hand-held controller
7 to be received by said receiver of said alarm circuit;

8 wherein said alarm circuit, upon receipt of said alarm signal from said hand-held
9 controller causes said alarm circuit to become operative, during which said sound generator will
10 activate in response to said motion sensor detecting movement of said footwear.

1 4. A method of protecting unattended footwear from theft, said footwear
2 including an alarm circuit having a sound generator and a motion detector, said motion detector
3 generating an output signal in response to movement of said footwear, the footwear protecting
4 method comprising the steps of:

5 switching said alarm circuit to an alarm mode;

6 detecting an output signal of said motion detector when in said alarm mode; and

7 activating said sound generator in response to detection of said output signal from
8 said motion detector, thereby audibly indicating movement of said unattended footwear and
9 preventing theft.

1 5. The method of protecting unattended footwear from theft, according to
2 claim 4, wherein said footwear further comprises an array of LEDs, said activating step further
3 comprising activating said LEDs to illuminate.

1 6. The method of protecting unattended footwear from theft, according
2 to claim 5, wherein said activating LEDs to illuminate step follows a prescribed sequence of
3 illumination within said LED array.

1 7. The entertaining sound-effects generator for footwear, according
2 to claim 1, wherein said alarm circuit further includes a receiver, said reset switch is located on a
3 hand-held controller which further includes a transmitter and a sound-effects switch, said sound-
4 effects switch controlling the transmission of at least one sound-signal from said hand-held controller
5 to said alarm circuit, said alarm circuit playing a predetermined sound in response to receipt of said
6 transmitted sound-signal.

1 8. The entertaining sound-effects generator for footwear, according to claim
2 7, further comprising an electronic memory for storing sound data, said sound data of said memory
3 being used by said sound generator to generate said predetermined sound.

1 9. The entertaining sound-effects generator for footwear, according to
2 claim 1, further comprising a least one illuminating element, said illuminating element being
3 selectively illuminated by said alarm circuit in response to said motion detector detecting movement
4 of said footwear.

1 10. The entertaining sound-effects generator for footwear, according to claim
2 1, further comprising a processor for controlling said sound generator in response to said motion

3 detector detecting movement of said footwear.

1 11. The entertaining sound-effects generator for footwear, according to claim
2 10, wherein said sound generator includes a speaker and a sound-driver circuit, said sound-driver
3 circuit effectively amplifying sound data from said processor prior to being sent to said speaker to
4 be played.

1 12. The entertaining sound-effects generator for footwear, according to claim
2 11, wherein said speaker is a piezo crystal.

1 13. The entertaining sound-effects generator for footwear, according to claim
2 1, wherein said sound generator includes a piezo crystal.

1 14. The entertaining sound-effects generator for footwear, according to claim
2 1, wherein said alarm circuit further includes a proximity sensor for detecting when an object is
3 within a predetermined distance of said footwear, said alarm circuit further includes means for
4 causing said sound generator to generate a sound in response to said proximity sensor detecting an
5 object in proximity to said footwear.

1 15. The entertaining sound-effects generator for footwear, according to claim
2 2, wherein said circuit further includes a proximity sensor for detecting when said circuit is more
3 than a predetermined distance from said remote switch, said circuit further includes means for

4 causing said sound generator to generate a sound in response to said proximity sensor detecting said
5 circuit outside the proximity of said remote switch.

1 16. An entertaining sound-effects generator for footwear, comprising:

2 an alarm circuit including a sound generator, said alarm circuit being attached to said
3 footwear;

4 a proximity sensor attached to said footwear, said proximity sensor adapted to detect
5 when an object is within a predetermined distance of said footwear; and

6 means for causing said sound generator to generate a sound in response to said
7 proximity sensor detecting the proximity of said object to said footwear.

17. An entertaining sound-effects generator for footwear substantially as described herein with
reference to, or as shown in, the accompanying drawings.

18. An anti-theft system for footwear substantially as described herein with reference to, or as
shown in, the accompanying drawings.

19. A method of protecting unattended footwear substantially as described herein with
reference to, or as shown in, the accompanying drawings.



INVESTOR IN PEOPLE

Application No: GB 0016011.9
Claims searched: 1 & 3-14

18

Examiner: Peter Easterfield
Date of search: 3 October 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): A3B (B8B3); G4N (NAFA, NCM, NPL, NPPXA2)

Int Cl (Ed.7): A43B 3/00; G08B 13/14

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2348310 A (BOSS)	1 & 3 at least
X, Y	GB 2228814 A (MAGRILL)	1 & 3 at least
Y	EP 0589607 A1 (RODGERS)	1 & 3 at least
Y	EP 0335467 A1 (INTERMEDIUM)	1 & 3 at least
X, Y	US 5126719 A (DESORBO)	1 & 3 at least
Y	WO 98/42220 A1 (SBH)	1 & 3 at least

X Document indicating lack of novelty or inventive step

Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

A Document indicating technological background and/or state of the art.

P Document published on or after the declared priority date but before the filing date of this invention.

E Patent document published on or after, but with priority date earlier than, the filing date of this application.